State Board of Education Approved
February 2002

AUTOMOTIVE: BRAKE SYSTEMS

Course Description
Automotive: Brake Systems **course offers training in the diagnosis and repair of hydraulic, mechanical, and electrical systems used in standard and anti-lock brake systems. Course content includes diagnosis, repair, and/or service technology of hydraulic and antilock brake systems to original equipment manufacture (OEM) specifications. Educational experiences simulate automotive service industry operations through training aids, laboratory facilities, and school-based learning opportunities.**
Course content prepares students for the Automotive Service Excellence (ASE) Brake System test, for entry level placement in the workforce, and for entry into post-secondary education.

Prerequisite(s): **Transportation Core**

Algebra I or Math for Technology II; Physical Science or Principles of Technology I (may be concurrent)

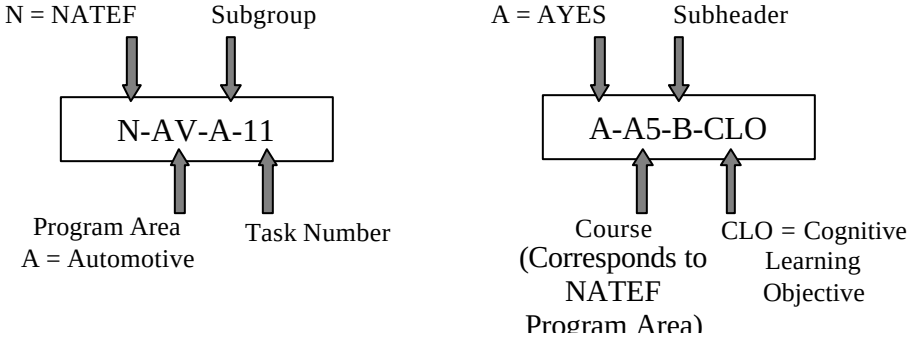
Requirement: **A minimum of 100 hours must be dedicated to brake systems to meet minimum standards set by NATEF.**

Recommended Credits: **1**

Recommended Grade Level(s): **10th, 11th, 12th**

Note: Course is aligned with NATEF task list for Automotive: Brake Systems. Items have been organized based on requirements of Tennessee required course description format.

Brakes



State Board of Education Approved
February 2002

AUTOMOTIVE: BRAKE SYSTEMS STANDARDS

1.0 Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

2.0 Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.

3.0 Students will apply fundamental science concepts to automotive brake technology.

4.0 Students will properly test, diagnose, service, and repair brake hydraulic systems.

5.0 Students will properly test, diagnose, service, and repair drum brake systems.

6.0 Students will properly test, diagnose, service, and repair disk brake systems.

7.0 Students will properly test, diagnose, service, and repair antilock brake systems (ABS).

8.0 Students will demonstrate communication skills required in the automotive service industry.

9.0 Students will demonstrate interpersonal and employability skills required in the automotive service industry.

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 1.0

Students will demonstrate leadership, citizenship, and teamwork skills required for success in the school, community, and workplace.

LEARNING EXPECTATIONS

The student will:
1.1 Exhibit positive leadership skills.
1.2 Participate in SkillsUSA-VICA as an integral part of classroom instruction.
1.3 Assess situations and apply problem-solving and decision-making skills to client relations in the community and workplace.
1.4 Demonstrate the ability to work cooperatively with others in a professional setting.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:
1.1 Demonstrates character, leadership, and integrity using creative and critical-thinking skills.
1.2.A Applies the points of the creed to personal and professional situations.
1.2.B Participates and conducts meetings and other business according to accepted rules of parliamentary procedure.
1.3.A Analyzes situations in the workplace and uses problem-solving techniques to solve the problem.
1.4.A Participates in a community service project.
1.4.B Assists with an officer campaign with Tennessee SkillsUSA-VICA.

SAMPLE PERFORMANCE TASKS

- Create a leadership inventory and use it to conduct a personal assessment.
- Participate in various SkillsUSA-VICA programs and/or competitive events.
- Evaluate an activity within the school, community, and/or workplace and project effects of the project.
- Implement an annual program of work.
- Prepare a meeting agenda for a SkillsUSA-VICA monthly meeting.
- Attend a professional organization meeting.
- Participate in the American Spirit Award competition with SkillsUSA-VICA.

INTEGRATION LINKAGES

SkillsUSA-VICA, *Professional Development Program,* SkillsUSA-VICA, Communications and Writing Skills, Teambuilding Skills, Research, Language Arts, Sociology, Psychology, Math, Math for Technology, Applied Communications, Social Studies, Problem Solving, Interpersonal

Skills, Employability Skills, Critical-Thinking Skills, SCANS (Secretary's Commission on Achieving Necessary Skills), Chamber of Commerce, Colleges, Universities, Technology Centers, and Employment Agencies

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 2.0

Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.

LEARNING EXPECTATIONS

The student will:

2.1 Determine the safe and correct application for chemicals used in brake systems.
2.2 Use protective clothing and safety equipment.
2.3 Use fire protection equipment.
2.4 Follow OSHA and EPA regulations and manufacturer specifications affecting brake systems technology.
2.5 Respond to safety communications referring to brake systems.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

2.1.A Conforms to federal, state, and local regulations and manufacturers specifications when handling, storing, and disposing of chemicals.
2.1.B Ensures proper ventilation for chemical use.
2.1.C Inspects first aid supplies.
2.2.A Demonstrates proper usage of special safety equipment.
2.2.B Selects and uses the appropriate protective clothing and eye protection.
2.3.A Distinguishes the proper fire extinguisher for each class of fire.
2.3.B Inspects fire extinguishers and determines their effectiveness.
2.4.A Locates regulatory information and manufacturer recalls.
2.4.B Extracts information from Material Safety Data Sheets pertaining to shop chemicals.
2.4.C Complies with relevant regulations and standards.
2.4.D Passes a written safety examination with 100% accuracy.
2.4.E Passes a performance examination on equipment with 100% accuracy.
2.4.F Maintains a portfolio record of written safety examinations and equipment examinations for which the student has passed an operational checkout by the instructor.
2.5.A Interprets brake systems manufacturer correspondence for safety regulations.
2.5.B Complies with safety procedures.

SAMPLE PERFORMANCE TASKS

- Assess the work area for safety hazards.
- Design a corrections program for identified hazards.
- Model the appropriate protective equipment for an assigned task.

- Read manufacturer specifications to determine safe practice while working on various brake systems.
- Using case scenarios, determine the results of unsafe practices including accidents, cost effectiveness, time management, and cost to the technicians.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 3.0

Students will apply fundamental science concepts to automotive brake technology.

LEARNING EXPECTATIONS

The student will:

3.1 Examine how physics concepts apply to automotive brake system operation.
3.2 Explore the application of fundamental laws of hydraulics to brake hydraulic systems.
3.3 Analyze the characteristics and properties of liquids as applied to automotive brake fluid.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

3.1.A Correlates the following concepts with their role in automotive braking systems: A-A5-1-CLO
- mass
- force
- acceleration
- energy
- heat
- temperature
- pressure
- friction
- coefficient of friction
- inertia
- momentum
- speed
- work
- torque
- power

3.1.B Examines the effects of weight and speed on braking and stopping distance. A-A5-1-CLO
3.1.C Explores thermal expansion of fluids, gases, and solids. A-A5-1-CLO
3.1.D Correlates principles of thermodynamics with automotive braking.A-A5-1-CLO
3.1.E Considering Newton's laws of motion, determines which concepts of force, mass, and acceleration apply to automotive braking. A-A5-1-CLO
3.1.F Considering Ohm's law of electricity, determines its effects on sensors applied to brake systems. A-A5-1-CLO
3.1.G Researches future concepts of electrical sensors and brake applications. A-A5-1-CLO
3.1.H Illustrates how motion converts to heat energy. A-A5-1-CLO
3.2.A Interprets the laws of hydraulics as applied to brake systems. A-A5-1-CLO
3.2.B Relates atmospheric pressure to the term vacuum. A-A5-1-CLO
3.3.A Assesses the characteristics of liquids. A-A5-1-CLO
3.3.B Determines the properties of automotive brake fluid.
3.3.C Considering Paschal's law of liquids, determines its effects on brake systems. A-A5-1-CLO

SAMPLE PERFORMANCE TASKS

- Calculate stopping distance for a vehicle of a given weight at a given speed.
- Diagram the process of braking, identifying the forces and principles at work in each step.
- Develop a community service presentation on safety using science concepts as a theme. Share the information with school and community organizations and enter the Tennessee SkillsUSA-VICA Community Service Competition.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 4.0

Students will properly test, diagnose, service, and repair brake hydraulic systems.

LEARNING EXPECTATIONS

The student will:

4.1 Diagnose brake hydraulic systems and determine necessary action.
4.2 Inspect and repair or replace master cylinders and lines of the hydraulic system.
4.3 Inspect and replace switches and valving devices.
4.4 Follow specific safety guidelines and regulations for brake fluids.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

4.1.A Diagnoses poor stopping, pulling, or dragging concerns caused by problems in the hydraulic system. N-AV-A-4
4.1.B Determines necessary action in response to diagnosis. N-AV-A-4
4.2.A Measures and adjusts pedal heights. N-AV-A-1
4.2.B Checks master cylinder for internal and external leaks and proper operation and determines necessary action. N-AV-A-2
4.2.C Removes, bench bleeds, and reinstalls master cylinder. N-AV-A-3
4.2.D Inspects brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tightens loose fittings and supports; and determines necessary action. N-AV-A-5
4.2.E Fabricates and installs brake lines (double flare and ISO types); replaces hoses, fittings, and support as needed. N-AV-A-6
4.2.F Selects and installs brake fluids to proper levels. N-AV-A-7
4.3.A Inspects, tests, and replaces metering (hold-off), proportioning (balance), pressure differential, and combination valves. N-AV-A-8
4.3.B Inspects, tests, replaces, and adjusts height (load) sensing proportioning valve. N-AV-A-9
4.3.C Inspects, tests, and replaces components of brake warning light system. N-AV-A-10
4.3.D Bleeds brake system through manual pressure, vacuum, or surge. N-AV-A-11
4.3.E Flushes hydraulic system. N-AV-A-12
4.4.A Handles and stores brake fluids according to relevant Occupational Safety and Health Administration (OSHA) safety standards. A-A5-3-CLO
4.4.B Uses material safety data sheets (MSDS) to maintain, interpret, and follow safety precautions and hazard recognition. A-A5-3-CLO
4.4.C Adheres to the use of personal safety clothing and equipment.
4.4.D Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices when inspecting, testing hydraulic brake systems (ABS) and components. A-A5-3-CLO

SAMPLE PERFORMANCE TASKS

- Remove and replace master cylinder.
- Pressure-bleed brake system.
- Using case scenarios, follow strategy based diagnostic procedure to:
  - Verify the complaint.
  - Define the problem.
  - Isolate the problem.
  - Validate the problem.
  - Make the repair.
  - Test the repair.
- Complete a repair order using technical writing skills and calculate salary earnings based on the repair order description.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Chemistry, Technology Literacy, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, Critical Thinking and Problem Solving, Computer Skills, Internet Navigation, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 5.0

Students will properly test, diagnose, service, and repair drum brake systems.

LEARNING EXPECTATIONS

The student will:

5.1 Diagnose drum brake systems and determine necessary action.
5.2 Remove, clean, and inspect drum brake assemblies.
5.3 Repair, replace, and adjust drum brake components.
5.4 Diagnose, remove, and replace pneumatic (vacuum) and hydraulic power brake boosters.
5.5 Follow specific safety guidelines and regulations for working on drum brake systems.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

5.1.A Diagnoses poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation concerns and determines necessary action. N-AV-B-1
5.1.B Diagnoses wheel bearing noises, wheel shimmy, and vibration concerns and determines necessary action. N-AV-E-1
5.1.C Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices when inspecting, testing, servicing, and repairing drum brake systems and components. A-A5-2-ALO
5.2.A Removes, cleans, inspects, and measures brake drums; services or replaces as needed. N-AV-B-2
5.2.B Mounts brake drum on lathe and machines braking surface. N-AV-B-3
5.2.C Removes, cleans, and inspects brake shoes, sprigs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricates and reassembles. N-AV-B-4
5.2.D Removes, inspects, and installs wheel cylinders. N-AV-B-5
5.2.E Removes, cleans, inspects, repacks, and installs wheel bearings and replaces seals; installs hub and adjusts wheel bearings. N-AV-E-2
5.2.F Checks parking brake cables and components for wear, rusting, binding, and corrosion; cleans, lubricates and replaces as needed. N-AV-E-3
5.2.G Checks parking brake operation and adjusts as needed. N-AV-E-3
5.3.A Pre-adjusts brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings. N-AV-B-6
5.3.B Installs wheel and torques lug nuts and makes final checks and adjustments. N-AV-B-7
5.3.C Checks operation of brake stop light system; adjusts and services as needed. N-AV-B-6
5.3.D Replaces wheel bearing and race. N-AV-E-7
5.4.A Tests pedal-free travel with and without engine running and checks power assist operation. N-AV-D-1
5.4.B Checks vacuum supply to vacuum-type power booster. N-AV-D-2

5.4.C Inspects vacuum-type power booster for vacuum leaks, inspects the check valve for proper operation, and determines necessary action. N-AV-D-3
5.4.D Inspects and tests hydro-boost system/accumulator for leaks and proper operation and determines necessary action. N-AV-D-4
5.4.E Removes and replaces vacuum or hydraulic booster. N-AV-D-2
5.5.A Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices when inspecting, testing drum brake systems (ABS) and components. A-A5-3-CLO
5.5.B Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices while servicing and repairing drum brake systems (ABS) and components. A-A5-3-CLO
5.5.C Adheres to the use of personal safety clothing and equipment.

SAMPLE PERFORMANCE TASKS

- Remove and replace wheel bearing and race.
- Check and adjust parking brakes.
- Using case scenarios, follow strategy based diagnostic procedure to:
  - Verify the complaint.
  - Define the problem.
  - Isolate the problem.
  - Validate the problem.
  - Make the repair.
  - Test the repair.
- Complete a repair order using technical writing skills and calculate salary earnings based on the repair order description.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 6.0

Students will properly test, diagnose, service and repair disc brake systems.

LEARNING EXPECTATIONS

The student will:

6.1 Diagnose disc brake systems and determine necessary action.
6.2 Remove, clean, and inspect disc brake system components.
6.3 Check operation of disc brake system and components.
6.4 Repair, replace, install, and adjust disc brake system components.
6.5 Diagnose, remove, and replace pneumatic (vacuum) and hydraulic power brake boosters.
6.6 Follow specific safety guidelines and regulations for disc brake systems.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

6.1.A Diagnoses poor stopping, noise, pulling, grabbing, dragging, or pedal pulsations concerns for disc brakes. N-AV-C-1
6.1.B Determines needed repair or service. N-AV-C-1
6.1.C Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices when inspecting, testing, servicing, and repairing disk brake systems and components. A-A6-4-CLO
6.2.A Removes caliper assembly from mountings; cleans and inspects for leaks and damage to caliper housing; determines necessary action. N-AV-C-2
6.2.B Cleans and inspects caliper mounting and slides for wear and damage; determines necessary action. N-AV-C-3
6.2.C Removes, cleans, and inspects pads and retaining hardware; determines necessary action. N-AV-C-4
6.2.D Disassembles and cleans caliper assembly; inspects parts for wear, rust, scoring and damage; replaces seal, boot, and damaged or worn parts. N-AV-C-7
6.2.E Cleans, inspects, and measures rotor with a dial indicator and a micrometer; follows manufacturer's recommendations in determining need to machine or replace. N-AV-C-7
6.2.F Removes, cleans, inspects, repacks, and installs wheel bearings and replaces seals. N-AV-C-6
6.3.A Checks operation of brake stop light system; adjusts and services as needed. N-AV-E-6
6.3.B Checks parking brake cables and components for wear, rusting, binding, and corrosion; cleans, lubricates, and replaces as needed. N-AV-E-3
6.3.C Adjusts calipers with integrated parking brake system. N-AV-C-9
6.4.A Removes and replaces rotor. N-AV-C-11
6.4.B Reassembles, lubricates, and reinstalls caliper, pads, and related hardware; seals, pads, and inspects for leaks. N-AV-C-11

6.4.B Adjusts calipers with integrated parking brake system. N-AV-C-9
6.4.C Installs wheel, torque lug nuts, wheel bearings, and hub; makes final checks and adjustments. N-AV-C-10
6.5.A Tests pedal-free travel with and without engine running and checks power assist operation.
6.5.B Checks vacuum supply to vacuum-type power booster. N-AV-D-2
6.5.C Inspects vacuum-type power booster for vacuum leaks, inspects the check valve for proper operation, and determines necessary action. N-AV-D-3
6.5.D Inspects and tests hydro-boost system/accumulator for leaks and proper operation and determines necessary action.
6.5.E Removes and replaces vacuum or hydraulic booster. N-AV-D-3
6.6.A Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices when inspecting, testing disc brake systems (ABS) and components. A-A5-3-CLO
6.6.B Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices while servicing and repairing disc brake systems (ABS) and components. A-A5-3-CLO
6.6.C Adheres to the use of personal safety clothing, eye protection, and equipment.

SAMPLE PERFORMANCE TASKS

- Resurface brake rotor.
- Remove and replace brake caliper.
- Using case scenarios, follow strategy based diagnostic procedure to:
  - Verify the complaint.
  - Define the problem.
  - Isolate the problem.
  - Validate the problem.
  - Make the repair.
  - Test the repair.
- Complete a repair order using technical writing skills and calculate salary earnings based on the repair order description.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 7.0

Students will properly test, diagnose, service, and repair antilock brake systems (ABS).

LEARNING EXPECTATIONS

The student will:

7.1 Test, inspect, and diagnose antilock brake systems (ABS) and components and determine necessary action.
7.2 Repair, service, replace, and adjust antilock brake system (ABS) components.
7.3 Demonstrate safe practices specific to antilock brake systems (ABS).

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

7.1.A Observes antilock brake system (ABS) warning light(s) at start-up and determines if further diagnosis is needed. N-AV-F-3
7.1.B Diagnoses poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determines necessary action. N-A-AV-F-2
7.1.C Diagnoses antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determines necessary action. N-AV-F-3
7.1.D Diagnoses antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). N-AV-F-8
7.1.E Diagnoses and tests antilock brake system (ABS) speed sensors and circuits following recommended procedures (including voltage output, resistance, shorts to voltage/ground, and frequency data). N-AV-F-10
7.1.F Inspects and tests antilock brake system (ABS) components and determines necessary action. N-AV-F-1
7.2.A Services and adjusts antilock brake (ABS) system speed sensors and circuits following recommended procedures. N-AV-F-7
7.2.B Depressurizes high-pressure components of the antilock brake system (ABS) following manufacturer's recommended safety procedures. N-AV-F-4
7.2.C Bleeds the antilock brake systems (ABS) front and rear hydraulic circuits following manufacturer's recommended procedure. N-AV-F-5
7.2.D Removes and installs antilock brake system (ABS) electrical/electronic and hydraulic components following manufacturer's procedures and specifications. N-AV-F-6
7.2.E Services, tests, and adjusts antilock brake system (ABS) speed sensors**.**
7.2.F Repairs wiring harnesses and connectors. N-AV-F-12
7.3.A Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices when inspecting, testing antilock brake systems (ABS) and components. A-A5-9-CLO

7.3.B Follows accepted service and safety precautions, manufacturer's recommended procedures, current regulations, and standard operating practices while servicing and repairing antilock brake systems (ABS) and components. A-A5-9-CLO

7.3.C Adheres to the use of personal safety clothing, eye protection, and equipment.

SAMPLE PERFORMANCE TASKS

- Use a scan tool and the appropriate Diagnostic Procedures Manual to test an antilock brake system (ABS).
- Bleed an antilock brake system (ABS).
- Determine the cause of an intermittent electrical problem in an antilock brake system (ABS).
- Using case scenarios, follow strategy based diagnostic procedure to:
  - Verify the complaint.
  - Define the problem.
  - Isolate the problem.
  - Validate the problem.
  - Make the repair.
  - Test the repair.
- Complete a repair order using technical writing skills and calculate salary earnings based on the repair order description.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 8.0

Students will demonstrate communication skills required in the automotive service industry.

LEARNING EXPECTATIONS

The student will:

8.1 Communicate and comprehend oral and written information typically occurring in the automotive service workplace referring to brake systems.
8.2 Solve brake problems and make decisions using a logical process, based on information communicated to them.
8.3 Use teamwork skills to accomplish goals, solve problems, and manage conflict within groups.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

8.1.A Interprets and uses written information in common job formats, such as tables, charts, and reference materials and manuals.
8.1.B Interprets and uses graphical information such as blueprints, electrical schematics, process control schematics, automotive flow charts, and other automotive diagrams referring to brake systems.
8.1.C Uses electronic resources to obtain diagnostic service and other automotive information.
8.1.D Analyzes information obtained from various sources to determine a diagnostic approach.
8.1.E Communicates clearly and appropriately in oral and written form.
8.1.F Interprets automotive repair orders for brake systems.
8.2.A Develops a hypothesis regarding the cause of a problem.
8.2.B Tests the hypothesis to determine the solution to the problem.
8.2.C Creates, evaluates, and revises as needed a plan to resolve a problem.
8.2.D Follows strategy based diagnostic procedure to verify the complaint, define the problem, isolate the problem, validate the problem, make the repair, and test the repair.
8.3.A Serves in each of the functional roles of a team within a service facility.
8.3.B Resolves conflicts within a group.
8.3.C Demonstrates appropriate and positive examples of giving and accepting criticism.
8.3.D Modifies behavior and revises work based on appropriate criticism.
8.3.E Cooperates with other members of a group to research future trends in brake systems.
8.3.F Evaluates the role of the automotive technician within the organizational system of a dealership or fleet shop.

SAMPLE PERFORMANCE TASKS

- Use reference materials to determine procedures for diagnosing and testing brake systems.
- Work as a team member to develop a diagnostic strategy.

- Use blueprints and diagrams to execute a task.
- Using case scenarios, follow strategy based diagnostic procedure to:
  - Verify the complaint.
  - Define the problem.
  - Isolate the problem.
  - Validate the problem.
  - Make the repair.
  - Test the repair.
- Complete a repair order using technical writing skills and calculate salary earnings based on the repair order description.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

AUTOMOTIVE: BRAKE SYSTEMS

STANDARD 9.0

Students will demonstrate interpersonal and employability skills required in the automotive service industry.

LEARNING EXPECTATIONS

The student will:

9.1 Analyze relationships between work ethics, organizational skills, and personal job success.
9.2 Demonstrate attitudes conducive to working in a team.
9.3 Compare the correlation between a clean orderly work environment and successful and efficient job performance.
9.4 Assess implications of diversity for communities and workplaces.
9.5 Develop individual time management and work sequencing skills.

PERFORMANCE STANDARDS: EVIDENCE STANDARD IS MET

The student:

9.1.A Illustrates the concept of a "work ethic."
9.1.B Assesses the potential impact of an individual's work ethic on an organizational system.
9.1.C Infers the relationship between work ethics and personal job success.
9.2.A Judges which attitudes are conducive to success.
9.2.B Modifies behavior to reflect attitudes for success.
9.3.A Keeps work area organized and free from clutter and maintains tool and equipment control.
9.3.B Cleans work area according to shop standard and NATEF, and OSHA requirements.
9.3.C Maintains a neat and orderly work area.
9.4.A Points out benefits and problems that may arise from diversity in manufacturers.
9.4.B Devises solutions to problems arising from diversity in both individuals, culturals, and manufacturers.
9.4.C Demonstrates proper dress and grooming for work in an automotive service facility.
9.5.A Assesses the benefits of incorporating time management principles into brake service.
9.5.B Displays time management and work sequencing skills in brake service.
9.5.C Demonstrates the ability to diagnose and repair brake service jobs within the manufacturer's labor operation time.

SAMPLE PERFORMANCE TASKS

- Maintain an orderly work area.
- Consistently arrive at class on time.
- Serve as an intern with a dealership or fleet shop.
- Resolve an interpersonal conflict in the classroom.

- Using case scenarios, follow strategy based diagnostic procedure to:
  - Verify the complaint.
  - Define the problem.
  - Isolate the problem.
  - Validate the problem.
  - Make the repair.
  - Test the repair.
- Complete a repair order using technical writing skills and calculate salary earnings based on the repair order description.

INTEGRATION LINKAGES

Mathematics, Math for Technology, Physics, Science, Technology Literacy, Applied Communications, Problem-Solving, National Institute for Automotive Service Excellence (ASE), National Automotive Technician Education Foundation (NATEF), SkillsUSA-VICA, AYES Curriculum, National Science Foundation, Computer Skills, Internet Navigation Skills, Presentation Skills, Critical Thinking and Problem Solving, Technical Writing Skills, Following Trouble Tree/Schematics, Secretary's Commission on Achieving Necessary Skills (SCANS), Occupational Safety and Health Administration (OSHA), Tennessee Occupational Safety and Health Administration (TOSHA), Environmental Protection Agency (EPA)

State Board of Education Approved
February 2002

AUTOMOTIVE: BRAKE SYSTEMS

SAMPLING OF AVAILABLE RESOURCES

A5 Automotive Brake Systems Course, AYES Curriculum, AYES Corporation, www.ayes.org

A5 Brake Systems, CD-ROM, Interactive Computer Based Training, DVP/CDX

Module 6 Brakes, Instructional Materials Laboratory (IML), University of Missouri

Curriculum Integrator, CORD Communications, Waco, TX 1998

Today's Technician Automotive Brake Systems, Knowles, Delmar Publishing

1999 Automobile Task List, National Automotive Technicians Education Foundation (NATEF), www.natef.org